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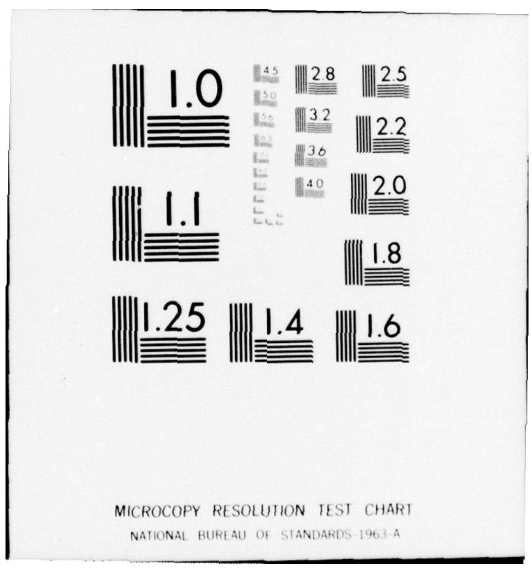
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SALT REGIME OF RESERVOIRS

Chapter 6: Elementary Hydrobiological Prognosis

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Hydrobiological prognosis basically reduces to weighing two factors accompanying outflow control: (1) blooming and overgrowth of a reservoir, depending on the growth possibilities of plant plankton or phytoplankton (trophicity of a reservoir), and (2) water quality viewed from the standpoint of possible growth of animal plankton (zooplankton) of various species typical of water of given quality (saprobicity of a reservoir).

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SALT REGIME OF RESERVOIRS

[City not given] GIDROKHIM. MATERIALY in Russian Vol 19 1951 pp 99-102

[Excerpt from chapter 6 by Ya. F. Pleshkov in the book "Gidrokhimicheskiye materialy," Vol 19, 1951, pp 99-102]

[Text] VI. Elementary Hydrobiological Prognosis

Hydrobiological prognosis basically reduces to weighing two factors accompanying outflow control:

1) blooming and overgrowth of a reservoir, depending on the growth possibilities of plant plankton or phytoplankton (trophicity of a reservoir)

2) water quality viewed from the standpoint of possible growth of animal plankton (zooplankton) of various species typical of water of given quality (saprobicity of a reservoir).

Blooming of water or mass growth of plankton algae raises technical difficulties in water utilization (plugging of the pipes of electric power station condensers, clogging the filters of station water pipelines and so on). Also, blooming degrades water quality; the water turns muddy, takes on coloration and unpleasant odors and taste and becomes enriched with decay products of drying algae.

As noted by K. A. Mudretsova-Viss [1], the blooming of water depends on numerous physicochemical conditions, above all, on how well algae--blooming components--are supplied with biogenic elements.

Among the biogenic elements are those normally found in bodies of water in small amounts, namely: salts of nitrogen, phosphorus and iron.

When nutrients are enough, blooming is determined by conditions of illumination and temperature. Vital for the temperature conditions of water (heating capacity) is the size of the shallow-water (littoral) zones of a reservoir.

From an overall weighing of all blooming factors, reservoirs are divided into these types:

1. Oligotrophic: plankton is poor, blooming is infrequent and littoral vegetation is undeveloped.

2. Mesotrophic: plankton is rich, blooming is frequent and littoral vegetation is significant.

3. Polytrophic: plankton is very rich, blooming is very profuse and frequent and littoral vegetation is highly developed.

The amounts of salts and growth of the littoral zone of these reservoir types are shown in Table 8.

Table 8. Salt Composition of Reservoirs of Different Types (in mg/liter)

(1) Показатели	(2) Тип водоемов		
	(3) олиготрофный	(4) мезотрофный	(5) политрофный
Аммиак (солевой) (6)	0,0— 0,3	0,3— 2,0	2,0— 15,0
Нитриты (7)	0,0— 0,5	0,5— 5,0	5,0— 15,0
Нитраты (8)	0,0— 1,0	1,0— 5,0	5,0— 15,0
Фосфаты (9)	0,1— 1,0	1,0— 3,0	3,0— 15,0
Железо (10)	0,2— 0,5	0,5— 1,0	1,0— 3,0
Карбонаты (11)	0,0—20,0	20,0— 80,0	80,0—200
Окись кальция (12)	0,0—25,0	25,0—100	100 —300
Хлориды (13)	0,0—10,0	10,0— 50,0	50,0—250
Сульфаты (14)	0,0—10,0	10,0— 50,0	50,0—100
Окись кремния (15)	0,0— 5,0	5,0— 25,0	25,0— 50,0
Литоральная зона (16)	Не развита (17)	Развита (18)	Сильно развита (19)

Key:

1. Indicators
2. Reservoir type
3. oligotrophic
4. mesotrophic
5. polytrophic
6. Ammonia (salt)
7. Nitrites
8. Nitrates
9. Phosphates
10. Iron
11. Carbonates
12. Calcium oxide
13. Chlorides
14. Sulfates
15. Silicon oxide
16. Littoral zone
17. Not developed
18. Developed
19. Greatly developed

The chemical composition of water is dependent on the hydrobiological data of a body of water: on the one hand, the composition of water and the presence in water of a certain reserve of nutrients influence algal growth; on the other hand, growing algae have some effect on the composition of water.

Thus, in parallel with algal propagation is a rise in the concentration of nitrogenous compounds in water; the concentration of mineral compounds essential to algae drops off somewhat.

However, this is perceptible only in small shallow, polytrophic reservoirs. But the biogenic factor does not figure prominently for large reservoirs of the mesotrophic and, in particular, the oligotrophic types, while the biochemistry does not play a strong role in the general hydrochemistry of the body of water.

Obviously, as a result of these factors, large reservoirs with large bodies of water and relatively deep reservoirs are not subjected to, or to a smaller extent are subjected to blooming and overgrowth compared with small reservoirs with small volumes and depths.

These circumstances are backed by the Vodgeo observations (engineer N. M. Bochkov) made for the reservoirs of the Donbass.

In addition to the blooming of water, we must look at the growth conditions of higher aquatic vegetation causing reservoirs to be overgrown.

Reservoir overgrowth is a negative factor, since it entails:

1) a drop in the reservoir capacity and an increase in the benthic deposits owing to the dying off of plants

2) retention of sediments and their deposition on the bottom

3) an increase in anophelogenicity owing to favorable conditions for the growth of mosquito larvae

4) plugging of water intake structures by masses of unrooted plants

5) plugging of cleaning structures

6) disturbance of the oxygen balance owing to the phenomenon of decomposition of dying vegetation. This phenomenon contaminates the body of water, accumulates biogenic elements spurring blooming and forms hydrogen sulfide; the outcome is that water turns unsuitable for drinking and industrial uses.

Shallow-water areas are also a prime factor for overgrowth. The characteristics of a reservoir as to the size of the littoral (most warmed) zone, in particular, within the most frequent working horizons, are an opportunity to give a prognosis of the reservoir becoming overgrown.

From the above we see that the extent of littoral sections of a body of water is enormously significant, as follows:

1) as the basis for determining the areas of possible overgrowth

2) as a general hydrobiological characterization

3) as a general hydrochemical characterization

4) as a general thermal characterization.

Besides the size of the littoral zone, significant to reservoir overgrowth is the clarity of the water and meteorological conditions (for example, the warming capacity of the water hastens overgrowth in the southern latitudes).

Lake overgrowth happens mostly in upwind locations (relative to the prevailing winds). Downwind shores are ordinarily free of brush, in spite of all other conditions conducive to overgrowth. Strong and often directionally variable winds mechanically block a quickening of plant growth.

The kind of soil also bears on overgrowth: loose soils do not let plants grow deep roots.

Level fluctuations typical of controlled reservoirs are destructive to numerous aquatic plants, but these fluctuations do not figure so large for some representatives of stiff vegetation, especially for rushes.

Clear waters promote overgrowth. From the remarks of G. I. Dolgov [1], some reservoirs in the Urals remain free of overgrowth solely because their water is only slightly transparent owing to the discharge of spent waters from the washing of dredges in platinum and gold recovery.

Reservoirs are characterized also by kinds of bacterial population (saprobicity of waters).

The saprobicity of a body of water, or its population of varied miniscule representatives of the animal kingdom, is an indirect indicator of water quality, since intrinsic to each qualitative state of a body of water are the corresponding groups of these representatives.

So we distinguish these main types of bodies of water:

1) oligosaprobic (pure)

2) mesosaprobic (regular, contaminated)

3) polysaprobic (highly contaminated water and wastewater).

Customarily, intermediate types (mesopolysaprobic and others) are also distinguished.

The classification of hydrobiological groups by saprobicity is done in course on hydrobiology.